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ABSTRACT

One of four research projects designed to examine barriers to the entrance of women into the workforce, the study described in this bulletin examined the feelings of math in students in single parent and nontraditional career preparation programs in relation to selected demographic characteristics. Survey instruments consisting of a brief math test (to evoke feelings of math anxiety in students prone to them) and an attitude scale were administered to 1,152 students in vocational-technical and comprehensive schools in 12 New Jersey school districts. At age 12, males felt slightly more math anxiety than females did. By age 14, however, females were more anxious about math than males were. The feelings of math anxiety expressed by females were consistently higher than those of males until age 19. As they aged, students of both sexes became significantly less anxious about their math abilities. Males in the African-American, Hispanic, Asian, and Native American groups exhibited high levels of math anxiety, as did females in the African-American and Hispanic groups. Math anxiety was significantly lower among students of both sexes who had completed college preparatory mathematics, algebra (I and II), and geometry. Actions recommended for confronting math anxiety included asking math instructors to conduct a self-assessment of gender and ethnicity disparities in the classroom, starting a math club for females, and learning the visualization technique of anchoring. (Contains 12 references.) (MN)

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BARRIERS TO WOMEN ENTERING THE WORKFORCE: MATH ANXIETY

RESEARCH BULLETIN NO. 3

Life Skills Center
Montclair State College

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New Jersey Equity Research Bulletin

Fall, 1992 *Life Skills Center, Montclair State* *Research Bulletin No. 3*

Barriers to Women Entering the Workforce: Math Anxiety

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During the 1991-92 school year the New Jersey Division of Adult and Occupational Education sponsored a study to examine math anxiety as it affects the ability of women to enter the workforce. In order to learn more about the effect of math anxiety a study was conducted by the Life Skills Center at Montclair State to measure the level of anxiety expressed and to examine the characteristics of the participants most likely to express feelings of math anxiety. Fear of math and working with mathematical concepts has been suggested as one of the factors which limit women in academic choices and career aspirations (Hunsley and Flessati, 1988). By understanding more about the characteristics of students suffering from math anxiety, programs can be developed to increase feelings of self esteem and confidence. This study was one of a four part research project concerned with examining barriers to women preparing to enter the workforce. Other barriers studied were sexual harassment, student knowledge and attitudes about nontraditional careers, and attitudes toward women in nontraditional roles.

Purpose

The purpose of the research project was to examine the impact of math anxiety on students enrolled in single parent and nontraditional career preparation programs and to examine feelings of math anxiety as related to selected demographic characteristics. A nontraditional career is defined as one held by seventy-five percent of the opposite gender. Additionally, the study examined participant characteristics most likely to be associated with feelings of math anxiety. Fear of math and working with mathematical concepts may be one of the factors which prevent women from choosing employment training programs which can lead to higher paying positions. Alexander and Martray (1989) define math anxiety as feelings of tension and anxiety which interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations.

Review of Literature

Math anxiety has been suggested as an explanation for the lack of interest on the part of females in math and science intensive career options. Females are thought to suffer more from math anxiety than males. However, these feelings may be the result of the commonly accepted attitude that math proficiency is a part of the male domain and that females are not expected to engage in math intensive careers (Singer and Stake, 1986). Flessati and Jamieson (1991) found that expressions of math anxiety are more acceptable for female than male students even though females exhibited superior proficiency in math. Females have been found to be less likely to select courses in mathematics. Students who have more extensive math experience and report success in math-related encounters are more likely to report lower math anxiety (Singer and Stake, 1986; Flessati and Jamieson, 1991; Tocci and Engelhard, 1991). In research conducted by Wigfield and Meece (1988) grade level has also been found to be significantly related to feelings of math anxiety. Ninth grade students, males and females, were found to be the most math anxious while those in the sixth grade exhibited the lowest levels of math anxiety. The AAUW Report (1992) *How Schools Shortchange Girls* indicates that no gender differences were found in the problem-solving abilities of middle school students. However, among students in the twelfth grade, males were more likely to be in the top 10-20 percent of students in all content areas of math with the exception of algebra. The National Science Board (1989) reports that similar percentages of girls and boys took the same math courses up to the calculus level of instruction. Calculus was taken by 7.6 percent of males but only 4.7 percent of female students. Fennema and Sherman (1977) found a strong correlation between math achievement and math confidence.

Procedure

This study was conducted, using a survey design, during the fall of 1991 with 1,152 students in twelve school districts located throughout New Jersey. Students in vocational technical schools and those in comprehensive schools were sampled. The instrument consisted of a short math test and an attitude scale to measure students' feelings of math anxiety. The math test was not used to measure math competence, but to allow the students to experience math anxiety in close proximity to the time when they were asked to indicate their feelings about math. Math comprehension was not assessed in this study.

Demographic Profile of Participants

- The sample was divided between males (51 percent) and females (49 percent).

- Participants ranged from 12 years to more than 20 years of age, with a median age of 15 years. The 17-year-old respondents formed the largest portion of the group and comprised 20 percent of the sample. The smallest group was the 19-year-old group, two percent of the sample.

- The sample was composed of:
  25% Single parents (n=231)
  75% not single parents (n=700)

- Race and ethnic composition of the sample:
  34% Caucasian
  25% African American
  10% Asian
  9% Native American

- Students enrolled in traditional career programs comprised 57% of the sample; nontraditional career programs 43%. (Traditional careers are defined as those in which males comprise 75% or more of the employees.)

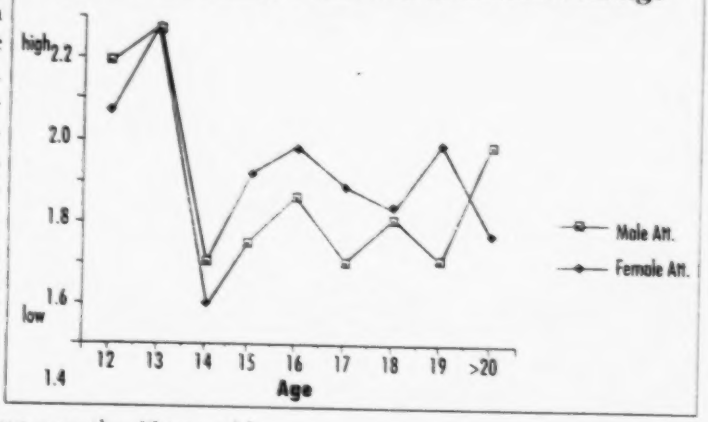
Math Anxiety and Student Characteristics

Analysis of the relationships between math anxiety and demographic characteristics indicated:

Gender, Age, and Math Anxiety

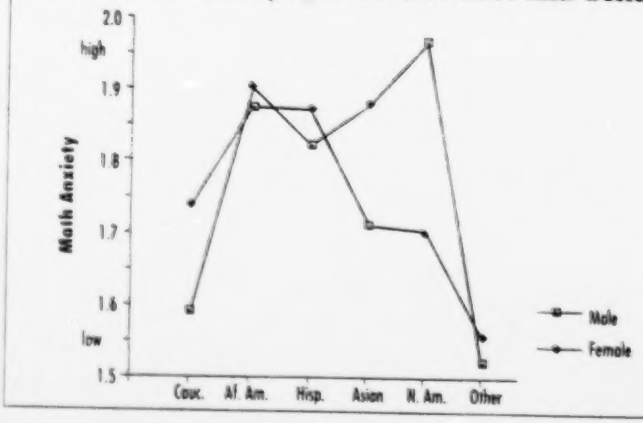
No significant differences were found in the general feelings of math anxiety for male and female students. However, when students were examined by age, the differences in their feelings about math became more apparent. Although not statistically significant at age twelve, male students express slightly more math anxiety than female students; at age thirteen the two groups exhibited similar feelings of anxiety; and by age fourteen female students were more anxious about math than male students. The feelings of math anxiety expressed by females were consistently higher than those of male students until age nineteen. The mean math anxiety score for males was significantly lower than that for females in the 14- to 19-year-old range. This finding supports other research findings that females are more anxious about their math abilities than males. The age at which they are most vulnerable to feelings of math anxiety is the period between twelve and thirteen years of age.

Fig. 1 Math Anxiety as Related to Gender and Age



Math anxiety was found to be related to age for all students. As students became older they became significantly less anxious about their math abilities. With each year of age the students exhibited less anxiety until age eighteen. The student group exhibiting the least math anxiety were those in the fourteen-year-old male group. Those exhibiting the most math anxiety were thirteen-year-old females and males. Because this appears to be the age at which girls, in particular, become less confident about their math abilities, programs should be implemented to help students through this difficult period. See Fig. 1.

Fig. 2 Math Anxiety as Related to Race and Gender



Gender, Race and Math Anxiety

Race was found to be significantly related to feelings of math anxiety. Males in the African American, Hispanic, Asian, and Native American groups exhibited high levels of math anxiety. The highest levels of math anxiety for females were found in African American and Hispanic groups. Among Asian and Native American groups, males were found to be higher in math anxiety than were female participants. Male and female African American and Hispanic groups were similar in their feelings of math anxiety. Among Caucasians, females were

found to be higher in feelings of math anxiety than were males. See Fig. 2.

Gender, Math Courses and Math Anxiety

Previous experience in math courses was found to be significantly related to feelings of math anxiety. For male students who had completed College Prep Math, Algebra I, Algebra II, and Geometry, feelings of math anxiety were significantly lower than for those who had not taken those courses. A similar finding was exhibited for female students who had taken College Prep Math and Algebra II. Although females who had taken Algebra I and Geometry experienced less math anxiety than those who had not taken these courses, the differences were not significant. See Fig. 3.

Fig. 3a Math Anxiety for Females as Related to Math Courses

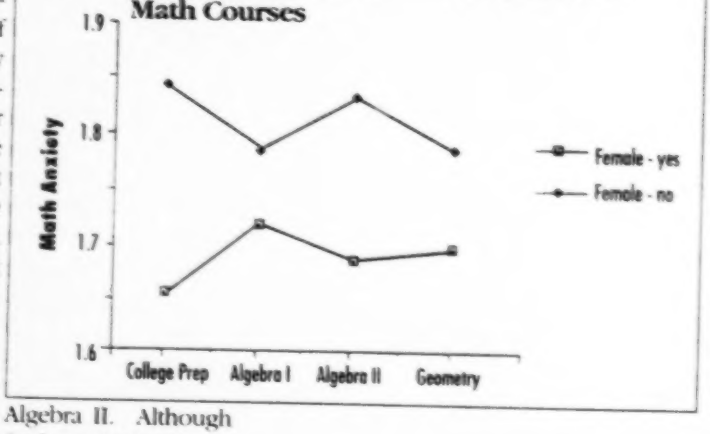
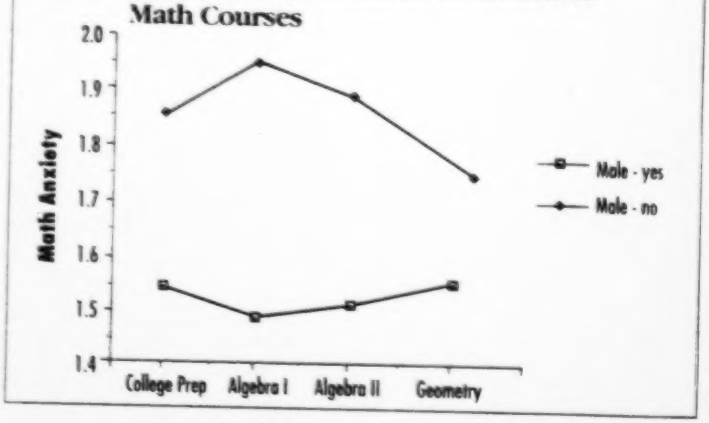


Fig. 3b Math Anxiety for Males as Related to Math Courses



Conclusions

Females have been considered by society to be less confident of their math abilities than male students and these feelings of math anxiety have been considered to be deterrents to their ability to perform in math courses and to their pursuit of math oriented careers. Although females have been found to be as proficient in math as males, they resist involvement in math experiences and are not as likely as males to select math oriented careers (Flessati and Johnson, 1991). Researchers have suggested that females do not see math as important to their lives and that math is not an important part of their self definition. Society has tended to view math as a male domain (Flessati and Johnson, 1991; Singer and Stake, 1986). Although females have not been expected to perform well in math oriented tasks, this competency is necessary for success in the workforce. Lack of preparation in mathematics has severely limited career options for females.

Gender was found to be significantly related to math anxiety for students between the years of fourteen and nineteen. Prior to age fourteen, males and females were found to be similar in their feelings of math anxiety. However, at age fourteen, males exhibited significantly lower levels of math anxiety than females. This finding indicates that programs to alleviate math anxiety need to begin in the elementary years. Females not only need to have reinforcing experiences in mathematics, but they need to see how math is important to their lives. Career options which require math proficiency need to be presented as suitable for both males and females.

Examination of demographic characteristics indicated that students who classified themselves as single parents, or who live in single parent households, and non-Caucasian respondents were most likely to indicate feelings of math anxiety. Programs need to be targeted to these populations in order that they be encouraged to engage in more math oriented experiences. These student groups are limited in career choices by their feelings of math anxiety. Many technologically oriented and managerial positions are not available to them because of their lack of ability to work with mathematical concepts. By increasing their proficiency in the area of mathematics, additional career opportunities will become available to them.

Experiences need to be provided for female students which increase their familiarity with a wider variety of career options. Young people, when choosing a career, think first of the types of jobs they have observed personally. Children who are raised in households with a single female head, think of jobs which have traditionally been held by females. Jobs which require mathematical proficiency have not been traditionally thought of as female dominated positions. However, if female children are exposed to varied job or career possibilities and are provided with adequate instruction in mathematics, a wider variety of

career options should become possible for females.

Recommendations for Action

The barrier of math anxiety can be confronted through the following types of activities:

1. **Analyze the situation** in your school. Survey students about their feelings about math. Consider your findings as they relate to ethnicity and gender of students in high and low level classes. Determine if significant disparities exist.

2. **Ask math instructors** to conduct a self assessment of gender and ethnicity disparities in the classroom as related to response opportunities, response time, feedback, listening, and higher order questioning.

3. **Start a math club** for females utilizing self esteem and confidence building activities, role models, and extra support in math.

4. **Offer adult women** considering entrance into nontraditional careers, math refresher courses in a stress free environment with an instructor skilled in techniques to reduce math anxiety.

5. **Provide opportunities for guidance** counselors to become knowledgeable about the importance of math for females and minorities. Inservice workshops on nontraditional assessment and counseling skills are helpful.

6. **Learn the visualization technique** called "Anchoring" which reduces anxiety and increases relaxation when thinking about math (Mitchell and Scannella).

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Participating School Districts

Bayonne Public Schools, Essex County Vocational Technical School, Gloucester County Vocational Technical School, Irvington Public Schools, Mercer County Vocational Technical School, Middlesex County Vocational Technical School, Monmouth County Vocational Technical School, Newark Public Schools, Paramus Public Schools, Pinelands Regional School District, Salem County Vocational Technical School, and Somerset County Vocational Technical School.

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